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## (54) Air treatment apparatus.

(57) Air treatment apparatus comprises an ozone generator (12), a reservoir (14) for terpenes, means (16) for reacting ozone from the generator with terpenes from the reservoir, and means (22 and 30) for releasing the products of the reaction to the atmosphere.

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This inv ntion relates to apparatus for treating the air in rooms or buildings particularly those having air conditioning or other environmental control systems or requiring a clean or purifi d environment.

Environmental control systems used in buildings have many advantages but generally suffer from two disadvantages, namely a tendency to multiply and spread bacteria and viruses and a tendency to produce an unnatural atmosphere less pleasant to work in than fresh air.

It is an object of the present invention to provide apparatus for treating air that obviates or mitigates these disadvantages.

The present invention makes use of the products of a reaction between ozone and naturally occurring conjugating molecules such as terpenes. These products are referred to in the art as the "open air factor". Such naturally occurring conjugating molecules, together with their man-made equivalents, will hereinafter be referred to as 'terpenes'.

The present invention is air treatment apparatus comprising a source of ozone, a reservoir for terpen s, means for reacting ozone from the generator with terpenes from the reservoir and means for releasing the products of the reaction to the atmosphere.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawing, the single figure of which is a diagrammatic cross section of apparatus according to the present invention.

Referring now to the drawing, the apparatus of this embodiment is provided as a free standing cabinet unit 10 in which are provided a source of ozone, in this embodiment an ozone generator 12, a reservoir 14 for terpenes, a reaction chamber 16 having an inlet 18 which receives ozone from the ozone generator 12 and terpenes from the reservoir 14, and an outlet 20 to an air duct 22 passing through the unit.

The duct 22 incorporates a fan 24 driven by an electric motor 26 which draws in air at an inlet 28 and passes it through the duct 22, past the outlet 20 of the reaction chamber, to a duct outlet 30.

The ozone generator 12 may be any convenient commercially available ozone generator such as a PCW2 Generator produced by Pure Air Corp. of Kansas City, U.S.A. The generator 12 takes in air from the duct 22 at a point 32 adjacent the duct inlet and passes an ozone/air mixture to the inlet 18 of the reaction chamber.

The terpene reservoir 14 has a filler inlet 34 through which the liquid terpenes are supplied to the reservoir and supplies terpenes to the inlet 18 of the reaction chamber 16, the terpen s being mixed with the ozone from the ozone generator at the inlet 18. The terpenes may be supplied to the inlet 18 by any suitable m ans which may be as simple as a wick or more complex as a preset dose spray system. It is, however, important that th terpenes are suppli d at a rate which ensures a surplus of terpenes aft r the terpenes have fully reacted with the ozone from the generator.

The reaction chamber 16 serves to maintain the ozone and terpene mixture together long enough to allow them to react fully and may be simply a glass container or as shown a container defining an internal labyrinth path from the inlet 18 to the outlet 20. The outlet 20 is a venturi outlet in the duct 22 and is matched to the air flow in the duct 22, the venturi providing the pressure differential to draw air through the ozone generator and with the ozone and terpenes through the reaction chamber.

The product of the reaction between the ozone and the terpenes, the open air factor, is then passed through the outlet 30 of the duct 22 to the atmosphere in the room in which apparatus is located and displays a marked biocidal activity on a range of bacteria and viruses thus reducing the risk of and spread of infection. The biocidal mechanism is not fully understood but appears to be related to the readiness of the reaction products to attach themselves to the bacteria and viruses and interfere with their metabolic processes. The desirable product concentration at the outlet 30 is between one and one hundred parts per hundred million, preferably between ten and one hundred parts per hundred million, and the ozone generator should be of a size to produce the quantity of ozone necessary to react completely with the terpenes to produce the desired product concentration. It should be noted that as the products are reactive the product concentration declines sharply between the reaction chamber and the duct outlet 30 so that the concentration at the outlet of the reaction chamber needs to be greater than the concentrations indicated above. The position is, however, complicated by the fact that ozone is produced by a wide range of equipment found in many offices such as photocopiers, laser printers, fluorescent lighting and electric motors, and it is, therefore, desirable to monitor the output of the ozone generator 12 by a unit 36 which shuts off the generator 12 when ozone in excess of preset limits is present at its outlet and which energises a warning light 38 when this condition has been reached.

A second warning light 40 may be provided to indicate a low level of terpenes in the reservoir 14.

The terpenes come from aromatic plants and flowers processed to condense and isolate those terpene components having a low vapour pressure. If more terpene is supplied to the reaction chamber than is necessary to react with the ozone, the unreacted terpenes enter th ambient atmosphere and make it more pleasant r sembling fresh air. Terpenes derived from oranges, lemons, roses, pine, thyme and basil have been found to b particularly effective.

The apparatus described may be provided as an

integral part of an environmental control system such as an air conditioning system. In that case th fan 24 may be dispensed with and the duct 22 would be replaced by a duct bypassing a percentage, say 25%, of the flow of the air conditioning system downstream of the air conditioning unit. In view of the larger volumes of air being treated it may also be desirable to incorporate the reaction chamber in the duct itself.

The apparatus shown in the drawing could also be modified by incorporating the reaction chamber in the duct 22, or by providing in the duct 22 immediately downstream of the fan 24 a source of ultraviolet light at a biocidal wavelength to weaken or kill bacteria and viruses over a slightly different spectrum from those mainly affected by the open air factor.

## Claims

1. Air treatment apparatus comprising a source of ozone a reservoir for terpenes, means for reacting ozone from the generator with terpenes from the reservoir and means for releasing the products of the reaction to the atmosphere.

2. Apparatus as claimed in claim 1, in which said means for reacting ozone and terpenes comprises a reaction chamber connected to receive ozone from the generator and terpenes from the reservoir.

3. Apparatus as claimed in claim 1 or claim 2, including a duct through which air is passed, an inlet to the ozone generator communicating with said duct.

4. Apparatus as claimed in claim 3 when dependent on claim 2, in which the reaction chamber outlet is connected into the duct downstream of the inlet to the ozone generator.

5. Apparatus as claimed in claim 4, in which the duct includes a fan.

6. Apparatus as claimed in claim 4 when dependent on claim 3, in which the reaction chamber is incorporated in the duct downstream of the inlet to the ozone generator.

7. Apparatus as claimed in claims 4 to 6, including a course of ultraviolet light at a biocidal wavelength upstream of the place where the ozone/terpene reaction products are pres nt in the duct.

8. A method of treating air in a space such as a room or building, comprising providing a source of ozone, reacting the ozone with terpenes and releasing the products of the reaction into the space.

9. A m thod as claimed in claim 8, including withdrawing air from the space, adding ozone from the source of ozone to withdraw air, adding terpenes to the ozone air mixture and returning the air with the products of the reaction to the space.

10. A method as claimed in claim 8, including withdrawing air from the space adding ozone and terpenes to the air and returning the air with the products of the reaction to the space.

11. Air treatment apparatus substantially as hereinbefore described, with reference to and as shown in the accompanying drawing.